

Problem S-1

For a stoichiometrically-simple reaction, occurring in a continuous reactor at steady state

$$\frac{n_i - n_i^0}{\nu_i} = \frac{n_1 - n_1^0}{\nu_1} = \frac{n_2 - n_2^0}{\nu_2} = \dots$$

where n_i = moles of i in effluent per unit of time

n_i^0 = moles i in feed per unit of time

ν_i = stoichiometric coefficient of i

Thus, the given reaction is "single" if

$$\frac{n_T - n_T^0}{-1} = \frac{n_{H_2} - n_{H_2}^0}{-4} = \frac{n_{H_2S} - n_{H_2S}^0}{1} = \frac{n_{C_4} - n_{C_4}^0}{1}$$

$$\frac{n_T - n_T^0}{-1} = -(0.29 - 0.65) \text{ gr.moles/min.} = +0.36 \frac{\text{gr.moles}}{\text{min.}}$$

$$\frac{n_{H_2} - n_{H_2}^0}{-4} = -\frac{1}{4}(12.27 - 13.53) = +0.315 \frac{\text{gr.moles}}{\text{min.}}$$

$$\frac{n_{H_2S} - n_{H_2S}^0}{1} = (0.56 - 0.59) = -0.03 \text{ gr.moles/min}$$

$$\frac{n_{C_4} - n_{C_4}^0}{1} = (0.38 - 0.20) = 0.18 \text{ gr.moles/min}$$

Above quantities are not equal. Therefore, reaction is not stoichiometrically-simple. If data are accurate, one or more additional reactions must be taking place.